INDIAN DRAGONFLIES

BY

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Part XXV

With 1 Plate and 5 Text-figures

(*Continued from page 426 of Vol. XXXI*)

Genus—MACROGOMPHUS, Selys.

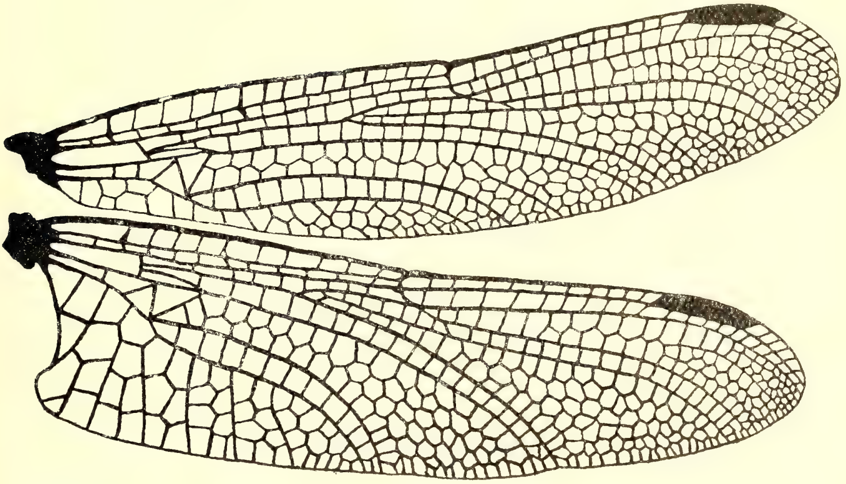


Fig. 1. Wings of *Macrogomphus seductus*, sp. nov., male.

Macrogomphus (Sely), (*Heterogomphus* pars), Bull. Acad. Belg., xxi (2), p. 27 (1854) ; id. Mon. Gomph., pp. 87, 428 (1857); id. Bull. Acad. Belg., vii, p. 334 (1859) ; id. ibid. (2), xlvi, p. 413 (1878) ; Will. Proc. U.S. Nat. Hist. Mus., xxiii, pp. 273 and 287 (1907) ; Laid. Rec. Ind. Mus., p. 375 (1922).

Arboreal Gomphines of large size, coloured glossy black with brightly contrasted yellow markings. Wings hyaline, reticulation close, base of hindwing of male deeply excavate, tornus prominent ; arc opposite, or a little distad of the 2nd antenodal nervure ; 2 rows of postanal cells in forewing 4 and 5 in the hind, where the 1st postanal cell is entire and extends basad only a little beyond the centre of base of subtrigone ; a basal incomplete antenodal nervure present in all wings ; the 1st and the 5th or 6th the primary antenodals ; 4 and 5 traversing nervures between *Mi-iii* and *Miv* in forewing, 4 in the hind ; all trigones, hypertrigones and subtrigones entire ; 3 rows of cells between *Mi* and *Mia* at level of outer end of pterostigma ; pterostigma small, barely equal to one-fourth the distance from node to outer end of pterostigma, braced ; *Cuii* pectinate in forewing ; *Cui* and *Cuii* in hindwing parallel as far as termen ; 2 rows of discoidal cells in forewing nearly to level of node ; 2 cubital nervures in forewing as a rule, only 1 in the hind ; sectors of arc parallel at origin, then divergent ; costal and basal sides of trigone in forewing sub-equal and both shorter than distal side ;

costal side of trigone of hindwing considerably longer than the basal and considerably shorter than the distal ; anal triangle 3-celled

Head moderately large, wide transversely ; frons strongly angulate ; occiput simple as a rule. Thorax robust ; legs short, armed with 2 rows of minute closely-set pines ; armature of mid and anterior femora scarcely differing, that of female similar, but spines more widely-spaced and fewer. Abdomen tumid at base, segments 3 and 6 thin and cylindrical. 7 and 8 moderately dilated, the 8th at least double the width of 6, segment 9 narrow and tapering, *nearly twice the length of 8, 10 very short and small.* Anal appendages of male longer than segment 10, the superiors with a long, fine, inner branch springing from about its middle. The inferior deeply cleft, its long branches as widely divaricate as the superiors and more or less sinuous. Genitalia prominent, lamina strongly arched, rather depressed ; anterior hamules short and spatulate ; posteriors robust, flattened, projecting markedly, furnished with an outer apical or subapical spine ; lobe scrotal-shaped, bluntly bifid. Vulvar scale variable, small, tapering and bifid at apex, or cleft as far as base into two small triangular processes.

Larva highly specialized, especially as regards the terminal abdominal segments (which are reflected in the imago). Head small and triangular, face pointed ; abdomen very long and cylindrical, the end segments greatly elongated and produced into a siphon-like structure. This curious tubular organ projects from the mud or sand whilst the rest of the body is submerged, and thus enables the insect to carry on rectal breathing without exposing its body. As one would surmise, the end segments are relatively longer in the earlier instars than in the adult stage.

Distribution. *Macrogomphus annulatus* is confined to Western India in the drier zones of the Deccan, whilst *M. wynaadicus* takes its place in the wetter montane areas. *Macrogomphus montanus, robustus,* and *seductus* (a new species described below) are from North India and Thibet. None so far have been reported from Burma and Ceylon, but *M. parallelogramma* (Burm.), *albardae* Selys *decemlineatus* Selys, *quadratus* Selys, *thoracicus* M'Lach., and *abnormis* Selys are found in Java, Sumatra, Tonkin, Borneo and the Malay Peninsula.

The habits of *annulatus* and *wynaadicus* have been studied by the present author. The imago emerges in a horizontal plane whilst the larva rests on rocks and stones in midstream. In spite of this, the long abdomen and wings reach full development unimpared. As soon as the wings are sufficiently dried, the imago sets off directly inland until it reaches higher ground, where it comes to rest high up in trees. It may thus be found a mile or more away from its parent stream, in the Deccan, where trees are few and far between. In the heavily wooded country of the Western Ghats, the insect at once rises to the tops of the tallest forest giants and may there be picked out with the aid of field-glasses, at heights of 100 ft. or more.

Pairing takes place in such retreats, the males never being seen in the neighbourhood of water, except at emergence.

As pointed out by Williamson, species of the genus fall into two well-defined groups, characterized by the close reticulation and greater curving of the main nervures at their distal ends, in the one group, and by the simpler reticulation and straighter nervures in the other, to which latter group, all Indian species belong.

Genotype—*Macrogomphus annulatus*, Selys.

Macrogomphus annulatus (Selys) (*Heterogomphus annulatus*) Bull. Acad. Belg., xxi, (2) p. 28 (1854) ; id. (*Macrogomphus annulatus*), Mon. Gomph., pp. 92,405, (1857) ; id. Bull. Acad. Belg. (2) xxviii, p.170 (1869) ; id. ibid. (2) xlvi, p. 414 (1878) ; Will. l.c., pp. 289, 290 (1912) ; Laid. l. c., p. 376 (1922) ; Fras. Rec. Ind. Mus., vol. xxvi, pp. 470, 471 (1924).

Male. Abdomen 45 mm Hindwing 35 mm.

Head black marked with citron yellow as follows :—The lateral lobes of labium, bases of mandibles, two very large transversely oval spots on labrum, large spot on each side of the postclypeus against the eye connected narrowly along the lower border of postclypeus, the upper surface of frons except at its extreme base and a small median point of black projecting into the yellow. Lastly an obscure spot on the vertex. Occiput straight, slightly raised, its border fringed with black hairs.

Prothorax black marked with a small spot of yellow on either side and a narrow anterior collar.

Thorax black marked with citron yellow as follows :—2 thick wedge-shaped antehumeral dorsal stripes, tapering to a point above, broadly confluent with a

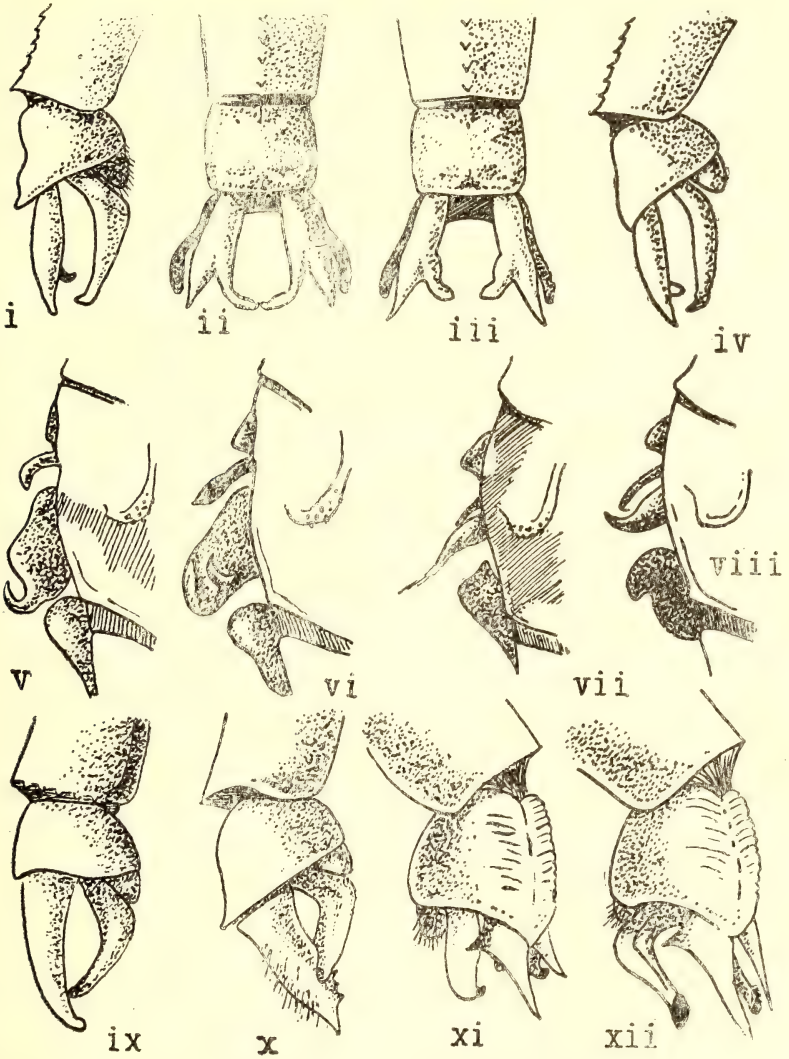


Fig. 2.—*Macrogomphus annulatus.*

i. Anal appendages of *Macrogomphus annulatus*, Selys, seen from the side. ii. The same dorsal view. iii. The same of *Macrogomphus seductus*, sp. nov. iv. The same seen in profile. v. Genitalia of *Macrogomphus annulatus,* Selys. vi. The same of *Macrogomphus seductus*, sp. nov vii. The same *Acrogomphus fraseri*, Laid. viii. The same of *Perissogomphus stevensi*, Laid. ix. Anal appendages of *Acrogomphus fraseri*, Laid. x. The same of *Perissogomphus stevensi*, Laid. xi. The same of *Anormogomphus kiritschenkoi*, Bart., dorso-lateral view. xii. The same of *Anormogomphus heteropterus*, Selys.

narrow, interrupted mesothoracic collar below, the inner border of these stripes parallel, the outer divergent below. The middle of ante-alar sinus narrowly yellow, the sides very broadly so and marked by a broad medial oblique black stripe which is bifid below to enclose a spot of yellow.

Legs black, coxæ and trochanters with a large yellow spot.

Wings hyaline, with a pale yellow ray in the cubital space. Nodal index $\frac{9-16}{10-11}\Big|\frac{16-11}{11-10}$; *2 cubital nervures in all wings*; pterosigma dark brownish black.

Abdomen black marked with citron yellow as follows:—segment 1 with the sides and dorsum broadly, 2 with a lanceolate dorsal bilobed stripe, the oreillets broadly and a latero-basal stripe, segments 3 to 6 with broad basal complete rings equal to nearly one-fourth the length of segments, 7 with its basal half yellow on dorsum, rather more than this laterally, 8 and 9 with a baso-lateral triangular spot.

Anal appendages. Superiors yellow, the inner border, branch and extreme apex rusty brown, broad at base, cylindrical and tapering to a fine point in the apical third, prior to which the inner branch is given off. The latter fine, directed obliquely in and back, the apical third bent abruptly inward and slightly flattened. Inferior appendage black, broadly split into two branches which are so wide apart at the base as to appear as two separate appendages, very sinuous, curling first in, then out and again in at the apex. Of the same length as superiors, narrow and rather irregular.

Genitalia. Lamina forming a gothic arch, prominent, coated with straight hairs; anterior hamules moderately long, sinuous, pointed at apex as seen in profile, spatulate as seen from below; posterior hamules very robust, broad, sloping back and projecting markedly. The extreme apex ending in a fine curled spine directed forward and in. (Text-figure 2, *v*.). Lobe scrotal-shaped, black, corrugated, deeply bifid into two conical nipple-like processes.

Female. Abdomen 49 mm. Hindwing 38 mm.

Differs in but few respects from the male, as follows:—The yellow markings more extensive, the stripe on frons broader, the spot on vertex is large and conspicuous, lying just in front of occiput. The thorax nearly always bears an upper humeral spot (rarely present in the male), and there are nearly always two spots on the lateral black band. The pterostigma is slightly longer, the nodal index higher $\frac{11-17}{11-14}\Big|\frac{18-9}{12-10}$; the occiput bears a bifid or trifid tubercle on its hinder border, occasionally separated as 2 or 3 robust spines; segment 9 is longer than in the male, whereas 10 is shorter. Vulvar scale glossy black, short, broad at base, tapering to a blunt point, bifid at apex but the two branches closely apposed.

Distribution. The Deccan bordering on the Western Ghats. The type (British Museum) probably came from Poona or Satara where I found the species quite common during September and October. It breeds in the Moolah River and from thence extends inland for long distances, nearly every acacia tree harbouring one or two specimens. Paratypes in the Morton, Laidlaw and my own collections.

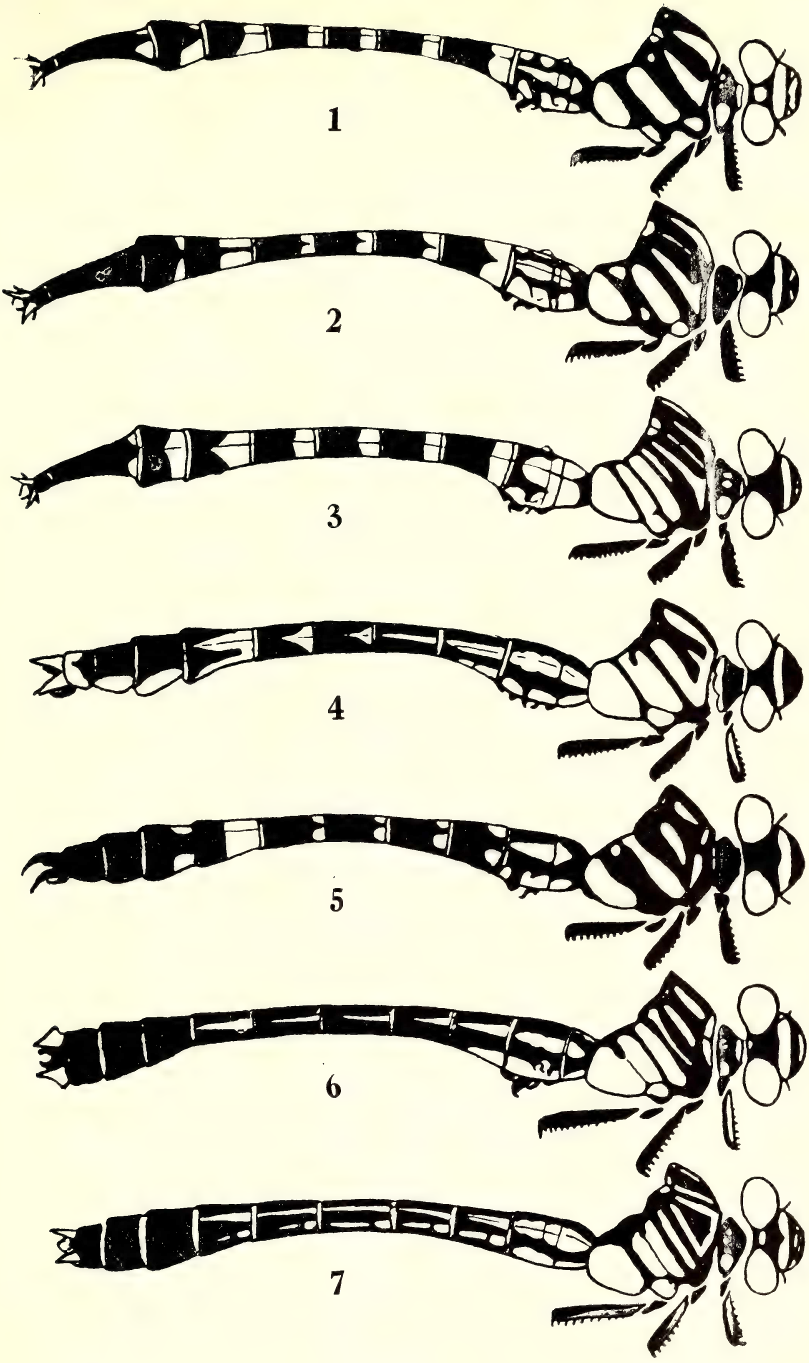
Macrogomphus wynaadicus, Fras., l.c. pp. 471, 472 (1924).

Female. Abdomen 53 mm. Hindwing 45 mm.

Closely related to *annulatus*, of which it may be a subspecies modified by the influence of a jungly habitat and a humid climate. It is a larger species and differs in a large number of minor details from *annulatus*, as follows:—

The yellow spots on labrum are almost obsolete; the face entirely black save for a small spot at each end of the postclypeus; the occiput is a little emarginate and without any vestige of the spines found in *annulatus*, a dark brown line bordering its front replaces the conspicuous yellow spot seen in that insect. Prothorax entirely black. Thorax very similar but without any humeral marking, the lateral black line, on the contrary, is marked with a medial yellow interrupted line.

Wings, in the type, rather darkly and evenly enfumed, but this may be mere evidence of old age; reticulation closer than in *annulatus*, the pterostigma covers 6-7 cells instead of only 4, and the nodal index is higher $\frac{14-20}{13-15}\Big|\frac{20-14}{14-13}$; 2 cubital nervures in all wings. Abdomen differing more markedly by having



1. Dorso-lateral view of *Macrogomphus annulatus*, Selys, male
2. The same of *Macrogomphus seductus*, sp. nov., male.
3. The same of *Macrogomphus montanus*, Selys, male.
4. The same of *Perissogomphus stevensi*, Laid, male.
5. The same of *Acrogomphus fraseri*, Laid., male.
6. The same of *Leptogomphus gestroi*, Selys, male.
7. The same of *Leptogomphus inclitus*, Selys, male.

(Figures 1, 2, 4, 5 and 6 drawn from specimens in the Fraser collection, figure 3 from a specimen in the Indian Museum collection, whilst figure 7 has been constructed from the Selysian description.)

paired spots instead of complete rings. Segment 2 has the dorsal stripe broadly broken at its centre, 3 with a large baso-lateral dorsal spot widely separated from its fellow by the black dorsal carina, 4 to 6 similar but the spots smaller, 7 has the yellow basal half split by a black dorsal carina as far as its base Segment 10 is longer and narrower than in *annulatus*.

Vulvar scale shorter, with convex hinder border, not bifid.

Distribution. Nilgiri Wynaad, Coorg and Western Ghats from North Kanara to Malabar. A rare insect although the larvæ and exuvia may be found abundantly in any stream throughout the area. I have only once seen the male, this particular specimen being perched on a tree overhanging the Mercara Sidapur Ghat Road. I wounded it with a charge of dust-shot but it managed to plane down into a thorny thicket, where although I could see it plainly, I was quite unable to reach it. I have seen vast numbers of exuvia on rocks in the Kibribetta stream, North Coorg, but never an imago was to be seen in the neighbourhood. Type in my own collection.

Macrogomphus robustus (Selys), (*Heterogomphus robustus*), Bull. Acad. Belg., xxi, (2), p. 27, (1854); Id. Mon. Gomph., pp. 88, 89 (1857); Id. Bull, Acad. Belg., xlvi (2), p. 414 (1878); Will. l.c., p. 289 (1912); Laid. l.c., pp. 375, 376 (1922).

Male. Abdomen (missing but by analogy with other species,—) about 45 mm. Hindwing 42 mm.

Head black, frons depressed, not notched, forming a very obtuse angle in front, marked with an orange stripe in front of ocelli; a blackish spot at side of mandibles; ocelli and lower lip partly brown; an obscure brown spot on clypeus; occiput not scale-like but with a large raised bifid tubercle at its middle, hairy in front and behind.

Prothorax black with a basal ring and a lateral spot yellow.

Thorax black, with 6 orange stripes, the two in front cuneiform, separated from each other, broader towards the mesothoracic notch which they do not quite reach and their apex not quite reaching the alar sinus; the two lateral, slightly oval, situated under each wing. A yellow spot at middle of antealar sinus and a large dorsal band of same on interalar space.

Legs entirely black. Abdomen missing.

Wings moderately broad, tinted with yellow ochre, especially towards the base; reticulation black; pterostigma brown, a little yellowish, moderately broad, 4 to 5 mm. long, over 6 cells, between black nervures, its end terminating in a paler line; anal border very excavate; membrane black, very slender but extending as far as anal angle; 19 antenodal nervures in forewings, 14 in the hind, 13 postnodal nervures in all wings. Female unknown.

Distribution. Thibet. A single, incomplete male in the Selysian collection. The species is distinguished by the labium entirely black; by the bifid tubercle on the occiput and lastly by its high nodal index. The latter character has induced me to separate it from *seductus*, a new species described below, to which also belongs the two males and single female in the Indian Museum placed by Laidlaw and Selys as *robustus*. The shape of the occiput also serves to separate it from *seductus* in which latter it is simple. The nodal index in *robustus* is $\frac{13\text{-}19}{13\text{-}?}\Big|\frac{19\text{-}13}{?\text{-}13}$, compared to $\frac{12\text{-}15}{10\text{-}10}\Big|\frac{14\text{-}10}{11\text{-}10}$ in *seductus*.

Macrogomphus seductus, sp. nov.

Male. Abdomen 50 mm. Hindwing 40 mm.

Head, labium black; labrum glossy black with two transversely elongate basal greenish yellow spots; anteclypeus black, postclypeus black, but its lower border and a large spot on either side against the eyes greenish yellow; frons black in front, broadly yellow above, where its base only is finely black; vertex and occiput black, the latter simple, neither spined nor tuberculated, fringed with long black hairs behind.

Prothorax black marked with a narrow anterior yellow collar.

Thorax black marked with citron yellow as follows:—Antehumeral stripes tapering to a fine point above at the alar sinus, very broadly confluent below with a slightly interrupted mesothoracic collar.

No humeral marking. Laterally the sides broadly yellow and marked by a broad medial oblique black band, which is itself marked by an upper small spot and a lower large spot.

Legs entirely black but trochanters and coxæ marked with yellow.

Wings palely saffronated, more deeply so at bases, especially in the cubital space Pterostigma black (dark brown by transmitted light), over 5 to 6 cells, braced ; nodal index $\frac{12\text{–}15 \mid 14\text{–}10}{10\text{–}10 \mid 11\text{–}10}$; membrane brown ; anal triangle 3-celled.

Abdomen black marked with citron yellow as follows :—Segment 1 with its apical half, the basal black encroaching on this subdorsally, where is a well-marked ridge resembling a second rudimentary oreillet bearing a fringe of long hairs, segment 2 almost entirely yellow, a broad basal ring, the oreillets except for a fine blackish brown bordering, and its sides broadly. The black on this segment is restricted to a broad subdorsal band ending basad abruptly at the jugal suture. Segments 3 to 6 with broad basal rings slightly notched by the black dorsal carina and covering nearly one-third of segment 3, one-fourth of 4 and rather less of 5 and 6, segment 7 with the basal half yellow, whilst 8 has an irregular baso-lateral stripe, segments 9 and 10 unmarked.

Anal appendages rather longer than segment 10. Superiors pale yellow, the apices carneous, as also the inner branch, which arises at middle of appendage is much shorter and stouter than in *annulatus* (only about half the length), and does not extend to apex of appendage. At the base of appendage is a long fine ventral spine. Inferior appendage glossy black, widely cleft, broad at base as viewed from below, tapering to a point. Branches sinuously curved as seen in profile, but not to the extent found in *annulatus*, divaricate, the extreme apices turned up rather abruptly.

Genitalia. Lamina narrow, more prominent than in *annulatus*, deeply and roundly arched ; anterior hamules spatulate, narrow at base, broadening apicad, convergent ; posterior hamules very robust, flattened, bluntly pointed at the apex where there is a pencil of long fine hairs. Subapicad is a small recurved spine ; lobe similar to *annulatus*.

Female. Abdomen 56 mm. Hindwing 44 mm.

Very similar to the male. Occiput slightly concave, simple. Prothorax black with three tiny obscure spots on the posterior lobe in addition to the anterior collar. Thorax and legs not differing from the male. Wings enfumed saffronation only evident at the bases ; nodal index $\frac{12\text{–}19 \mid 18\text{–}12}{11\text{–}12 \mid 13\text{–}11}$; 2 cubital nervures in all wings ; the 1st and 6th the primary antenodals ; pterostigma black, over 5 to 6 cells. Abdomen similar to the male but the subdorsal black fascia on segment 2 confluent over dorsum, and the dorsal carina on segments 4 to 7, especially 6 and 7 black, the basal rings being split into basal paired spots.

Anal appendages creamy yellow, very short, conical.

Vulvar scale very short, glossy black, bifid as far as its base into two small but broad triangular processes.

Distribution. Hasimara, Duars, Bengal. A single pair in my own collection (the male the type), taken by Mr. H. V. O'Donel. Two males and a female in the Indian Museum, the former two doubtfully referred to *robustus* by Laidlaw, the latter labelled *robustus* by De Selys himself. It is to be noted that Selys never described the female of *robustus* however, and mentions it as unknown. The differences between *robustus* and *seductus* have already been pointed out under the description of the former. From *montanus* it is easily distinguished by the total absence of a humeral stripe, etc. The Indian Museum specimens come from Sibsagar, Assam.

Macrogomphus montanus, Selys, Bull. Acad. Belg. (2), xxviii, p. 171 (1869) ; Will. l.c., p. 289 (1912) ; Laid. l. c., p. 377 (1922).

Male. Abdomen 50 mm. Hindwing 38 to 40 mm.

Head black marked with yellow as follows :—Two rather large oval basal spots on labrum ; labium yellowish ; the lower border of postclypeus, a stripe on the upper border of frons. Occiput brown, its border raised into a small conical tubercle at the middle.

Prothorax black, unmarked.

Thorax black marked with antehumeral stripes similar to those of *seductus*, but rather longer and wider (roughly these marks may be compared to the outline of a tintack with its head below). In addition there is a narrow humeral stripe gradually tapering away to a fine point below. The sides of thorax broadly yellow the two lateral sutures being finely mapped out in black, Wings hyaline, palely enfumed, reticulation close, brown ; pterostigma dark brown, over **5** to 6 cells ; nodal index $\frac{12\text{–}18}{10\text{–}11}\Big|\frac{20\text{–}11}{12\text{–}11}$.

Legs dark blackish brown.

Abdomen black marked with yellow as follows :—Segment 1 almost entirely yellow, 2 with a basal ring confluent with a dorsal stripe and a broad spot on the oreillets, 3 to 6 with basal rings as in *annulatus* but longer and occupying about one-third of the segments. On segments 3 and 4 these rings prolonged along the dorsum shortly, segment 7 with the basal half yellow and also prolonged along the dorsum, segment 9 with a small baso-lateral spot.

Anal appendages very similar to those of *annulatus*, thick at base, divaricate, tapering to a point in the apical half. The inner branch springs from the middle of appendage, slopes downwards and inwards, is black in colour, its apex bevelled to a point and extending a little beyond apices of superior appendages. Inferior appendage black, nearly as long as superiors, widely and deeply forked, branches more divaricate than superiors.

Female. Abdomen 47 mm. Hindwing 40 mm.

Very similar to the male, differs by the yellow markings rather more extensive. Wings tinted with yellow at base and along costal margin ; pterostigma pale brown ; nodal index slightly higher.

Occiput yellow, its border bicrenulate and with a tubercle situated behind, similar to, but larger than that of male. (This tubercle is not visible from the front.)

Segment 2 has the dorsal stripe broader and bilobate, the rings on the other segments distinctly broader. Anal appendages yellow, conical, very tiny and inconspicuous. Vulvar scale similar to *seductus*.

Legs dark reddish brown, tibiæ on the outer side, and also the hind femora, reddish brown.

Distribution. Sylhet. Type in Selysian collection. A pair in the Indian Museum determined by Selys, but without data as to locality.

This species is at once distinguished from all other Indian forms by the presence of a humeral stripe and the sides of thorax marked with two fine black lines instead of the thick medial black stripe.

Genus—ACROGOMPHUS, Laidlaw

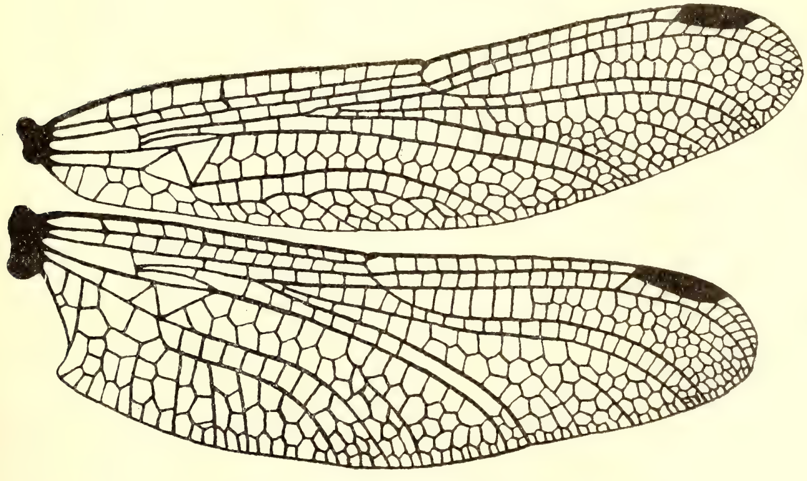


Fig. 3. Wings of *Acrogomphus fraseri*, Laid., male.

Acrogomphus Laid., Proc. Zool. Soc., Part 2, pp. 439, 440 (1925).

A genus of moderately large arboreal Gomphines coloured black with brightly contrasted but restricted yellow markings. Wings hyaline or tinted at the base with yellow ; reticulation close ; base of hindwing of male oblique but rather deeply excavate, tornus prominent ; arc lies between 1st and 2nd, or between 2nd and 3rd antenodal nervures ; sectors of arc parallel at, and for a short distance after origin, then divergent ; 1 or 2 rows of postanal cells in forewing, 3 to 4 in the hind, the 1st postanal cell in latter entire or divided, and extending inward to well proximad of the inner end of base of subtrigone, forming a distinct anal loop in the genotype ; no basal incomplete antenodal nervures ; the 1st and the 5th or 6th the primary antenodal nervures ; 3 to 5 cross nervures between *Mi-iii* and *Miv* in forewing, 2 to 3 in the hind ; all trigones, subtrigones and hypertrigones entire ; 1 to 2 rows of cells between *Mi* and *Mia* at level of distal end of pterostigma, which is equal to about one-fourth the length of distance from node to outer end of pterostigma, braced ; *Cuii* markedly pectinate in forewing ; *Cui* and *Cuii* parallel in hindwing as far as termen ; 2 rows of discoidal cells in forewing to beyond level of node in the male, to well short of node in the female ; 1 cubital nervure in forewings, 1 or 2 in the hind ; trigones with distal side longer than costal and costal longer than basal in forewings, trigone in hindwing more elongate than in fore ; anal triangle 4-celled.

Head large, face deep, frons forming a slightly obtuse angle with face ; occiput simple. Thorax robust ; legs rather short, hind femora extending only to base of segment 1. All femora with a field of robust, short, closely-set spines on the flexor surface, lengthening distad and less numerous on the middle and anterior femora.

Abdomen tumid at base, thin and cylindrical from segment 3 to middle of 7, then widening again to the end, segments 8 and 9 with distinct lateral leaf-like prolongations.

Genitalia variable in the species. Lamina narrow, arched, prominent ; anterior hamules moderately long narrow processes with a recurved hook at apex ; posterior hamules more robust, broad at base, tapering to a fine point, sloping back ; lobe of penis moderately large and prominent, scoop-shaped.

Anal appendage variable in the species, superiors simple, long, curved and tapering ; inferior deeply cleft, branches slightly divaricate. Vulvar scale short, deeply incised.

Distribution. India and Malaysia.

Geno-type. *A. fraseri*, Laid.

Acrogomphus fraseri, Laid. l.c., 11·441–443 (1925).

Male. Abdomen 44 mm. Hindwing 38 mm.

Head : labium variegated with shades of brown ; labrum black with a semilunar spot, greenish yellow, on either side of middle line ; bases of mandibles, anteclypeus, the upper part of frons and a slight overlapping of its crest yellow. Base of frons above, vertex and occiput black, the latter simple, emarginate and with a minute notch at its centre.

Prothorax black, unmarked.

Thorax black marked with bright citron yllow as follows :—A narrow interrupted mesothoracic collar, a pair of wedge-shaped antehumeral stripes not extending as far up as the alar sinus, and falling well short of the mesothoracic collar below, squared above, pointed and divergent below. Laterally a broad stripe on the mesoepimeron, the posterior three-fourths of the metepimeron, and a small spot of yellow above and between them.

Legs black, the inner surfaces of anterior femora bright yellow, a small spot of the same colour at the middle of the outer side of mid femora and a larger spot on the hinder femora.

Wings palely saffronated throughout, this deepening gradually to a golden yellow near the bases. Nodal index variable $\left.\frac{11-18}{12-12}\right|\frac{18-11}{12-11}$ $\left.\frac{11-16}{12-12}\right|\frac{16-12}{12-12}$, $\left.\frac{9-15}{10-11}\right|\frac{16-8}{11-9}$; pterostigma black, braced, over 5 cells ; 1 cubital nervure in all wings ; anal loop well-developed, formed of 2 cells and extending proximad nearly to level of cubital nervure ; discoidal field in forewing of 2 rows of cells to beyond level of node ; membrane black.

Abdomen black marked with bright citron yellow as follows :—Segment I with a triangular dorsal spot, its base resting on apical border of segment, laterally a large spot, segment 2 with a linear middorsal stripe slightly expanded basad, and two spots on each side, one of which includes the large oreillet, the other apical, segments 3 to 6 each with a pair of subdorsal basal spots decreasing in size from 3 to 6, segment 3 has also a small middorsal subbasal spot. Segment 7 with the basal half yellow, the yellow invaded by the black dorsal carina behind and in front, and separated narrowly from the base of segment by a narrow basal black ring. Segment 8 with a subbasal spot on each side, and 9 with a similar but much smaller (occasionally absent in some specimens).

Anal appendages black. Superiors dark reddish brown, almost black, broad at base, tapering to a fine point, curved down at apices and regularly curved inwards towards each other as seen from above so as to enclose a fusiform space very similar to what is found in *Onychogomphus circularis*, Selys. Inferior cleft into two branches almost as far as its base. Viewed laterally this appendage slopes sharply down in its basal third, then recurves sharply upwards as a rounded right angle. Branches of even width except the extreme apex which thins rather abruptly. From below the branches are divaricate, broad at base, tapering rapidly to a blunt point, which turns out slightly at the apex.

Genitalia. Lamina small, prominent, arched as a large segment of a small circle ; anterior hamules thin, moderately long, directed back, and in the apices ending in a small needle-like point which turns abruptly outwards ; posterior hamules somewhat similar in shape but larger and more robust, sinuous, ending in a point which is directed back and in ; lobe scoop-shaped, prominent, black.

Female. Abdomen 43 mm. Hindwing 40 mm.

Very similar to the male, the wings broader, rather less saffronated than in the male, the abdomen broader, stouter, cylindrical throughout.

Markings a little broader, the two spots on the sides of segment 2 confluent to form a complete lateral stripe ; the carinal spot on 3 larger ; the lateral spots on 8 and 9 absent ; the labium pale brown ; occiput similar to male but there is a large conical spine at each end, situated well back of the inner corner of eyes. Spines on femora fewer, more widely spaced and more robust. Nodal index :—

$\frac{12\text{–}21}{14\text{–}15}\Big|\frac{18\text{–}12}{15\text{–}13}$, $\frac{13\text{–}18}{14\text{–}14}\Big|\frac{19\text{–}14}{14\text{–}14}$, $\frac{12\text{–}21}{13\text{–}15}\Big|\frac{20\text{–}12}{15\text{–}14}$; 1 cubital nervure in forewing, 1 to 2 in hind.

Vulvar scale extends less than half the length of segment 9, bifid almost to base, its two branches divaricate, separated by a broad rounded notch, the branches broadly and bluntly triangular.

Distribution. Coorg, at altitudes of 3,000 ft. Type in the Laidlaw collection, paratypes in the Morton and my own collections. Only 3 pairs of this rare and beautiful insect are known but possibly its rareness is due to its habit of roosting at great heights, often as much as a hundred feet or more above the ground. I have watched females ovipositing in the Sampaji stream, generally in tunnels formed by cane brakes arching and covering over the stream. They drop their eggs in clean water where the current is swift and the bottom sandy or gravely. At such spots they hover about one inch above the surface of the stream, glide forward for a few feet, reverse rapidly in their own length and return. This manœuvre is repeated again and again, a hovering pause taking place before each turn to give time for a fresh batch of eggs to be extruded. With each glide, the insect dips and strokes the eggs off on the water's surface. Females are occasionally seen crossing open glades, flying low and trailing the abdomen as if it were fractured. With the aid of field-glasses males could be seen at times perched on prominent dead twigs on the tops of trees, or soaring at great heights in company with *Orogomphus campioni* and *Zygonyx iris*. In appearance, this species greatly resembles *Onychogomphus circularis* Selys, the anal appendages especially being a close copy of those of that insect. Dr. Laidlaw conjectures that *circularis* may be found to belong to genus *Acrogomphus*. The type has been damaged, but recently another specimen has come into my hands, and I am now able to confirm it as an *Onychogomphus*.

Genus—PERISSOGOMPHUS, Laidlaw.

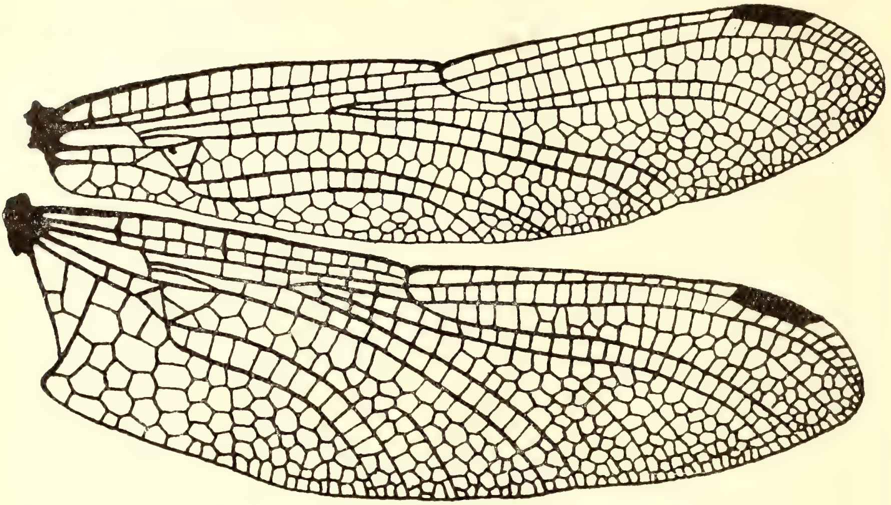


Fig. 4. Wings of *Perissogomphus stevensi*, Laid., ♂.

Perissogomphus, Laid., Rec. Ind. Mus., vol. xxiv, pp. 383, 384 (1922) ; Fras, ibid., p. 418 (1922).

A monotypic genus, the only known species of which is of moderately large and robust build, coloured black marked with grass-green. Wings hyaline, reticulation very close and redundant ; base of hindwing in the male oblique but moderately deeply excavate and tornus well angulated. Arc between the 2nd and 3rd antenodal nervures ; sectors of arc approximated immediately after origin, then slightly divergent ; the 1st and 6th or 7th the primary antenodal nervures ; 2 to 3 cubital nervures in forewings, 2 in the hind ; 4 cells in anal triangle ; 2 rows of postanal cells in forewing, 5 in the hind where the 1st cell is divided into 2 or 3 cells so as to form a distinct anal loop as in *Ophiogomphus*, which extends basad to well proximad of the inner end of base of subtrigone ; no basal incomplete antenodal nervure ; *Cui* in forewing markedly pectinate ; *Cui* and *Cuii* in hindwing divergent towards termen, 5 cells between their ends ; 2 rows of discoidal cells in forewing to a little beyond level of node; 1 to 2 rows of cells between *Mi* and *Mia* at level of outer end of pterostigma ; pterostigma small, less than one-fourth the length of distance between node and distal end of pterostigma, swollen, braced, over 4 to 5 cells ; 4 nervures between *Mi-iii* and *Miv* in forewing, 2 in the hind ; *Miii* and *Miv* distinctly sinuous ; trigones entire or traversed (One male has the trigone of left forewing and both in the hindwings traversed, another has only those of the hind traversed, whilst others have all entire ; two females have the trigones of forewings only traversed, another has the trigone of left forewing and both in the hind, whilst five others have those of hindwings alone traversed) ; subtrigones and hyper-trigones entire ; trigone of forewing with its sides subequilateral, the outer side a little angulate ; trigone of hindwing longer, with distal side longer than costal and costal longer than basal. (When trigones are traversed, the traversing nervure runs from basal to distal side.)

Head moderately large, frons rounded, face oblique ; occiput simple, hinde border straight, fringed with long black hairs, a small tubercle on its dorsum which bears a tiny longitudinal sulcus. Similar in the female but the tubercle smaller, rounded and without the sulcus. Thorax robust. Legs moderately long and robust, extending to apical border of segment 1 ; hind femora with 2 rows of short robust closely-set spines ending distad in a field of smaller spines. Mid and anterior femora very similar but without the field of spines and those forming the two rows smaller and less numerous. In the female, the spines more robust, longer and less numerous.

Abdomen tumid at base, thin and cylindrical from segment 3 to 7, where the segments gradually dilate as far as 10. Segments 8 and 9, and apical half of 7 with distinct lateral narrow foliations.

Anal appendages closely similar to those of genus *Gomphus*, both superiors and the branches of inferior divaricate.

Genitalia prominent; lamina narrowly and deeply arched, projecting prominently; anterior hamules long narrow hooks ending in a long fine backwardly curved spine; posterior hamules thick at base, robust, ending in a sharply curved, forwardly directed spine; lobe pitcher-shaped with its rim strongly emarginate.

Vulvar scale very short, very broad, its free border presenting two widely divaricate minute triangular processes.

Distribution. Assam, Bengal and Sikhim.

Genotype.—*Perissogomphus stevensi*, Laid.

Perissogomphus stevensi, Laid. l. c. pp. 384, 386 (1922); Fras., *ibid.*, p. 418 (1922).

Male. Abdomen 36–38 mm. Hindwing 33–34 mm.

Head: labium olivaceous; labrum olivaceous brown, its anterior border narrowly black, the outer corners and a pair of small median spots near the middle of anterior border yellow; anteclypeus and adjacent portion of postclypeus olivaceous; postclypeus dark olivaceous brown with an obscure large area against the eyes yellow. Frons deeply and widely notched at its centre, a beautiful grass-green above and in front, its extreme base above narrowly black; vertex and occiput black.

Prothorax black, the posterior lobe, a spot almost confluent with it, and a narrow anterior collar greenish yellow.

Thorax black on dorsum, grass-green laterally. The dorsum with a broad grass-green, M-shaped marking formed by the confluence of broad antehumeral stripes, which extend from the alar sinus, with a complete mesothoracic collar below. The middle limb of the M is formed by the middorsal carina which is green in its lower two-thirds, and confluent with the mesothoracic collar below. Laterally the vestiges of an upper dark brown, narrow stripe, and the hinder suture finely mapped out in the same colour.

Legs black, inner surfaces of anterior femora and distal half of same area on the mid femora greenish-yellow. Wings hyaline, a faint tinge of yellow at the extreme base in cubital area. Pterostigma blackish brown between thick black nervures; nodal index :—$\frac{12\text{–}16}{14\text{–}13}\Big|\frac{17\text{–}14}{12\text{–}13}$, $\frac{13\text{–}18}{13\text{–}12}\Big|\frac{17\text{–}11}{12\text{–}13}$.

Abdomen black marked at the base with grass-green, on other segments with citron yellow, as follows :—segments 1 to 7 with a middorsal stripe, broad on segment 1, trilobed on segments 2 and 3, broad at base on 4 to 6, on which segments it is confluent at the base with a narrow complete ring, and thereafter tapers away to a fine point, segment 7 similar but much broader at base, tapering less abruptly, and confluent at the base with a broad ventrolateral stripe which runs the full length of segment. The sides of segments 1 and 2 broadly grass-green, a triangular baso-lateral spot on segment 3 yellow, the sides of segments 8 to 10 broadly yellow-ochre, as also the apical half of dorsum of 10, where are seen two small round subdorsal subapical black spots.

Anal appendages yellow. Superiors as long as segment 10, a little divaricate, conical, tapering, acuminate, the apex slightly upturned and bearing beneath 4 or 5 small blackish brown spines. Inferior appendage about two-thirds the length of superiors, curling slightly up, deeply cleft into two short conical bluntly pointed divaricate branches. Genitalia. (See under genus.)

Female. Abdomen 38–41 mm. Hindwing 35–37·5 mm.

Entirely similar to the male, the face however more yellowish, the labium paler and the markings on abdomen more extensive, the whole of segment 10 being yellow. Nodal index :—$\frac{13\text{–}18}{16\text{–}13}\Big|\frac{17\text{–}14}{12\text{–}14}$; wings much more broadly tinted with yellow at base, as far out as the end of cubital space and along costa as far as the node. In one female, the whole wings are deeply and evenly enfumed brown, probably due to old age. The anal loop as highly developed as in the male.

Hind femora, as well as the other pairs, broadly yellow internally, and a fine diffuse stripe of the same colour on the outer surface, Anal appendages very short, conical, pointed, yellow. Vulvar scale (see under genus).

Distribution. The insect is taken during May and June. I have received specimens from Mr. H. Stevens taken at Gopaldhara, Assam, and others from Mr. C. M. Inglis taken near Pashoke, Darjeeling District.

The generic name implies ' redundancy ', and is well suited to this insect in which the venation is extraordinarily close considering the size of the insect, and by comparison with other Gomphines. Its venation is a curious blending of archaic with modern characters, a circumstance which makes it extremely difficult to determine relationships with other genera, it is however evident that broad gaps separate it from all other Indian genera.

Genus—ANORMOGOMPHUS, Selys

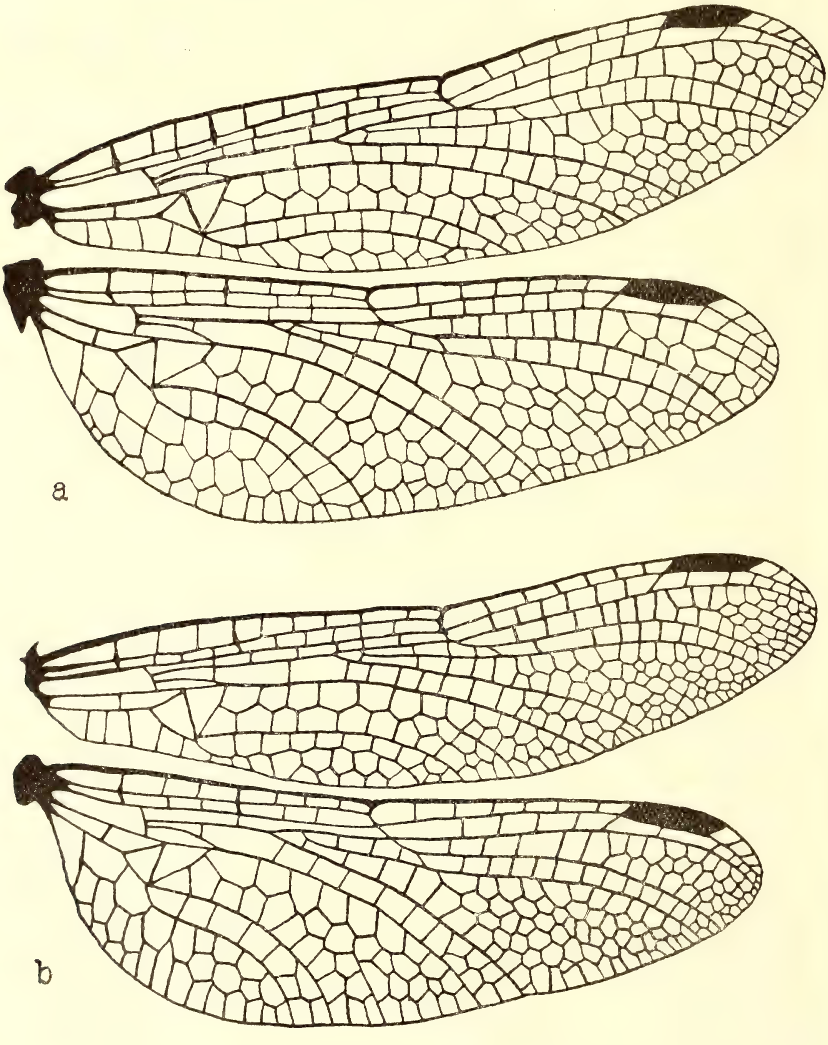


Fig. 5. *a* Wings of *Anormogomphus kiritschenkoi* Bart., male.
b. Wings of *Anormogomphus heteropterus*, Selys, male.

Anormogomphus, Selys, Bull. Acd. Belg. xxi, (2), p. 60 (1854) ; Mon. Gomp., p. 102 (1857) ; Will. l. c., p. 298 (1912), Laid. l. c., p. 396 (1922).

A genus of small Gomphines (equal in size to that of *Microgomphus*) characterized by their uniform pale colouring, without markings.

Wings hyaline, reticulation very open and simple, *base of hindwing rounded in both sexes, tornus absent*; arc between the 1st and 2nd, or opposite the 2nd antenodal nervure; sectors of arc parallel at, and for a short distance after origin, then divergent; a single row of cells in the postanal area of forewing, three in the hind, the 1st postanal cell in hindwing entire and extending proximad only as far as middle of base of subtrigone; no basal incomplete antenodal nervure; the 1st and the 4th the primary antenodal nervures, two cross nervures between *Mi-iii* and *Miv* in forewing, only one in the hind; all trigones, subtrigones and hypertrigones entire; trigone of forewing with costal and proximal sides equal, the distal rather longer; trigone of hindwing with costal side longer than proximal, and distal longer than costal; distal and costal sides of trigone of hindwing occasionally failing to meet, the gap being bridged by *Miv* to form a primitive four-sided trigone; only a single row of cells between *Mi* and *Mia* at level of distal end of pterostigma; pterostigma large and swollen, equal to a little more than one-fourth the length of distance between node and distal end of pterostigma, strongly braced; *Cuii* markedly pectinate in forewing; *Cui* and *Cuii* parallel in hindwing as far as termen; two rows of discoidal cells in forewing as far as level of node; one cubital nervure in all wings; *anal triangle single-celled.*

Head moderately large, frons angular, occiput flat and simple.

Thorax robust; legs rather long, extending well on to segment one; hind femora with a field of black, short, robust closely-set spines, the distal one rather longer than the rest, mid and anterior femora with smaller, more closely-set spines.

Abdomen slightly tumid at base, terminal segments slightly dilated in the male, of even width and cylindrical throughout in the female.

Genitalia prominent, lamina depressed, minutely notched; anterior hamules small and fine; posterior hamules long, projecting almost perpendicularly, tapering to a point, the apex with a tiny hook; lobe funnel-shaped, large and tumid. Vulvar scale very small, two small widely-divaricate, triangular scales.

Anal appendages very short. Superiors conical, pointed, widely separated, with a robust basal spine on the outer side; inferior deeply cleft into two widely divaricate branches each of which ends in a small black pin-head cap.

Distribution. Only two species are known, one of which is restricted to desert areas in Iraq, Persia and Sind, and the other to Bihar, Bengal and the Punjab. *A. kiritschenkoi*, Bart., the desert species, appears to be the more primitive, its reticulation being very open and simple, whilst *heteropterus*, Selys, has the venation much more close and static. The genitalia and anal appendages show that the two insects are intimately related.

Genotype—*Anormogomphus heteropterus*, Selys.

Anormogomphus heteropterus, Selys, Bull. Acad. Belg., xxi, (2), p. 61 (1854); Mon. Gomph., p. 103 (1857); Will. l.c., p. 293 (1912); Laid. l.c., p. 396 (1922).

Male. Abdomen 25 mm. Hindwing 22 mm.

Head pale whitish yellow, the eyes and ocelli brown and contrasting strikingly with the pale ground colour; an obscure brown line at base of frons above, and another in front of occiput. The latter simple, depressed, its border angulated at an obtuse angle.

Prothorax sandy yellow with obscure brownish transverse lines.

Thorax darker yellow with a grass-green tinge laterally. The dorsum with obscure vestiges of brownish lines, a median lining each side of middorsal carina convex inwards, an antehumeral stripe, more distinct, running obliquely from above down and out and lastly a humeral stripe, only visible at its middle part.

Wings pale, reticulation open, black, costa bright yellow; pterostigma pale yellow between black nervures, short, and stout, over 1 and 2 cells, braced; nodal index $\frac{5-9}{6-7}\Big|\frac{10-5}{7-6}$; 2 rows of discoidal cells, to beyond level of node.

Legs sandy yellow with black spines.

Abdomen pale sandy yellow marked with dark brown as follows:—A spot on each side of segment 1, a baso-lateral and an apico-lateral on segment 2, the latter spot transversely elongate, the jugal sutures and articulations of segments 3 and 6, these segments also having a small blackish brown spot on each side of the apical border ; segment 7 has a pale yellow basal ring, 8 and 9 a dorsal stripe on the carina of the same colour. The sides of these two latter segments, and of 10 darker yellow. The apical border of segment 10 rounded and not turned down between the anal appendages as in *kiritschenkoi*. Anal appendages yellow. Superiors a little shorter than segment 10, tapering to a fine point, widely separated, their inner borders parallel, the outer dilated at the base and prolonged downward as a very robust short tooth. Inferior appendage bifid, with widely separated branches, divaricate, their outer border thickened, tapering slightly towards the apex which ends in a curious oval black pin-head like structure.

Genitalia. Lamina depressed, shallowly notched ; anterior hamules small, conical, tapering ; posterior hamules more robust, projecting perpendicularly to long axis of abdomen, of even thickness to apex where they are abruptly conical and end in a short fine inwardly curved black spine ; lobe large, tumid, deeply bifid at lip, scoop-shaped.

Female. Abdomen 27 mm. Hindwing 25 mm.

Very similar to, but larger than the male. Closely resembles in many respects the female of *kiritschenkoi*, but the reticulation of the wings is much more redundant, as in the male.

Head (missing in the only known specimen of the sex).

Prothorax similar to the male. Thorax yellow laterally, grass-green on dorum with some obscure dark brown stripes, viz.—the upper part of the middorsal carina, a well-defined antehumeral stripe running from the alar sinus above, very obliquely down and out and becoming lost in its lower third. A short obscure line on the upper part of the humeral suture and a broken line on the second lateral suture.

Legs greenish-yellow with black spines, numbering about 15-20 on the hinder femora.

Wings hyaline, similar to the male, nodal index $\frac{5\text{–}9}{6\text{–}7}\Big|\frac{10\text{–}6}{7\text{–}7}$; *Cuii* pectinate in forewing ; two rows of discoidal cells to well beyond level of node.

Abdomen yellow with a greenish tinge, marked obscurely as follows :— Segments 2 and 7 with a subapical, subdorsal oblique linear spot on each side convergent apicad ; segments 8 and 10 ferruginous with the subdorsum and subapical borders clouded with black, segment 10 with the base similarly clouded on the dorsum.

Anal appendages ferruginous, very small, conical, separated by a similarly coloured conical structure. Vulvar scale very minute, two tiny triangular processes on either side of hinder border of segment 8.

Distribution. Type, a male in the Selysian collection, from India, without further data as to locality, collected by Stevens. There is a male from Lahore in the Indian Museum collection and a third male in my own collection from Bihar, the latter very teneral and without any evidence of markings. The only female known is one in my own collection, without head and anterior two pairs of legs. Its colour is well preserved, especially of thorax. This specimen comes from Baghwonie, Bengal and I believe was taken by Mr. C.M. Inglis, June 27, 1922. The insect appears to be much rarer than *kiritschenkoi*, or it may be overlooked on account of its weak flight and colourless body and wings. The above description has been taken from the Bengal specimen.

Anormogomphus kiritschenkoi, Bartenef.

> Morton (*Odonata from Mesopotamia*), Ent. Month. Mag. (3), vol. v, pp. 143-151, 183-196 (1919) ; Id., Ann. Mag. Nat. Hist. (9), vol. v, pp. 296, 297 (1920).

Male. Abdomen 29-31 mm. Hindwing 24-25 mm.

Very similar to the last species but rather more colourless, and the reticulation of wings more simple and open.

Head. Lips, face and vertex palest greeny white or creamy, the ocelli and eyes dark brown and strongly contrasted against the pale ground colour. Occiput pale, its hinder border obtusely angled prothorax palest yellow, rather darker on the dorsum. The posterior lobe and a transverse ridge in front of it brighter greenish-yellow. Thorax pale green, yellowish in some specimens but very variable and almost grass-green in others, unmarked. The dorsum a darker olivaceous.

Legs yellow, all femora with a longitudinal brown line on the outer sides, dark and well-defined distad, paler and diffuse proximad, and much darker and better defined on anterior than hinder femora. Spines shorter but more numerous and more closely-set than in *heteropterus*.

Abdomen sandy yellow with subapical, subdorsal spots on segments 2 to 6 exactly similar to *heteropterus*. Segments 7 to 10 unmarked.

Anal appendages yellow, the superiors with a pale greeny tint, the inferior ferruginous. Superiors very broad at base, conical, ending in a sharp point, outer borders oblique and ending in a very robust basal brownish spine, widely separated by a prolongation of segment 10, which dips down between them and ends in two small conical tubercles, each with a dark brown spine at its summit. Inferior deeply bifid, with widely divaricate branches which are bluntly pointed and end in a small black apex.

Genitalia very similar to that of *heteropterus*. Lamina very depressed, its surface with a narrow deep fissure dividing it up into two convex areas; anterior hamules conical and short in profile, sloping back and down, parallel, flattened as seen from below; posterior hamules much more robust, conical, ending in a tiny forwardly directed spine, cream coloured, projecting very slightly back, and almost perpendicularly so, to long axis of abdomen; lobe dark olivaceous, scrotal-shaped, narrowly but deeply notched at apex.

Wings hyaline, costa and most of the nervures pale straw coloured; pterostigma pale with a pinkish tinge, between black nervures, over three cells, braced; nodal index $\frac{7-8}{6-6}\Big|\frac{9-6}{6-5}, \frac{6-10}{7-7}\Big|\frac{10-6}{7-7}$; discoidal field in forewing with two rows of cells nearly to level of node.

Female. Abdomen 29–31 mm. Hindwing 26–27 mm.

Similar in all respects to the male; nodal index $\frac{6-9}{6-7}\Big|\frac{9-6}{7-6}$; two rows of discoidal cells in forewing to level of node; pterostigma slightly longer. Vulvar scale as for genus.

Distribution. Iraq, Persia along the shores of the Gulf, the Mekran coast and Sind. I took this species in large numbers at Zobeir, Mesopotamia, in April 1915, when in camp during the War. Its numbers were so great as to afford an exclusive diet for a large family of lizards I was keeping at the time. Its flight is weak and not sustained. It may be found near its breeding places settled gregariously on low bushes, or in grass. At Zobeir, the inhabitants dig holes in the sand for their water supplies, fresh pits being dug as one becomes fouled. It is in these pits that *kiritschenkoi* breeds.

Baghdad is the most northern locality from which I have received specimens, it occurs later there, towards the end of August. It is probably not uncommon along the banks of the lower Indus.

(*To be continued*)